NEWSLINE

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JASPER gas gun shocking science

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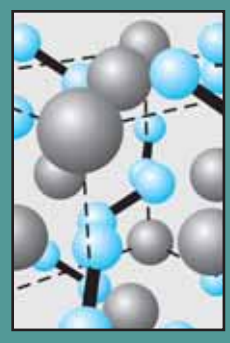
WHAT'S INSIDE



News you can use

‘Science on Saturday’ lecture series begins with a look at the dynamics of waves

The Lab’s popular lecture series, “Science on Saturday,” returns March 4 and runs through April 1. Kicking off the series on March 4 is “Waves in Nature: Lasers to Tsunamis and Beyond,” presented by Ed Moses and Rick Sawicki, of LLNL, and Dan Burns, teacher at Los Gatos High School.

Waves are in your life everyday and in every way. Microwaves are waves, laser beams are waves, music is sound waves, tsunamis are water waves and the entire universe is filled with electromagnetic waves emanating from the Big Bang.

Waves are sometimes useful and sometimes destructive. Microwaves cook our food and enable cell phone communication. Recent worldwide disasters have shown the enormous and devastating power that naturally occurring waves can generate. The Indian Ocean Earthquake of 2004 generated a tsunami that traveled at hundreds of miles per hour around the world, causing catastrophic damage to nearby continents.

Lasers waves can generate enormous amounts of energy and power that behave in many ways similar to a tsunami. Fortunately, we know how to create and control them for the benefit of humankind.

“Science on Satuday” includes demonstrations, videos and audience participation. The first 600 students attending March 4 will receive a hands-on science experiment demonstrating waves.

2006 *Science on Saturday*

March 4 — “Waves in Nature: Lasers to Tsunamis and Beyond” Ed Moses and Rick Sawicki, LLNL, and Dan Burns, teacher, Los Gatos High School

March 11 — “Diet and Cancer: Are Cooked Meats Involved?” Mark Knize, LLNL, and William Southam, teacher, Castro Valley High School

March 18 — “Life on Earth: Instructions in Three Billion (Tiny) Letters or Less” Daniel Barsky, LLNL, and Frankie Tate, teacher, Granada High School

March 25 — “Climate Change: What We Know and What We Need to Learn” Dave Bader, LLNL, and Barry Marson, teacher, Tokay High School, Lodi

April 1 — “Repairing DNA: Our Best Defense Against Cancer” John Hinz, LLNL, and Kirk Brown, teacher, Tracy High School

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All lectures are held at the Amador Theater, 1155 Santa Rita Road, Pleasanton. Two presentations will be offered on each Saturday — 9:30 and 11:15 a.m. Seating is on a first-come, first-served basis and there is no pre-registration.

The five-week series of free lectures and demonstrations is targeted at middle and high school students. Topics are selected from the forefront of science and technology research in a variety of disciplines.

Presentations are aligned with the California Science Standards and are sponsored by LLNL and Sigma Xi of Livermore. For more information, directions and a map, go to the Web at http://education.llnl.gov/sos

The Employee Assistance Program serves employees and dependent family members

Kay Gorsuch, Employee Assistance Program manager, talks with an employee client.

The Laboratory’s Employee Assistance Program (EAP), located in Health Services, Bldg. 663, can help employees assess a situation, aid with referrals, or address short-term concerns. On-site services include:

- Individual short-term counseling and consultation: for workplace, personal or family issues.
- Management and supervisory consultation: confidential consultation for managers concerned about an employee’s well being, changes in work performance, or other work-related behavioral concerns.
- Crisis response services: both individual and group critical incident debriefings and grief processing, when an employee group has experienced a traumatic event or loss of a co-worker.
- FFD and mandatory evaluations: assessment, evaluation, and referral for employees who have been referred through a formal LLNL policy and procedure process.
- Education and training: on a wide variety of topics from stress reduction and balancing work and life issues, to coping with change in the workplace.

The Lab follows a model that allows up to eight appointments for each problem. Initial visits to the EAP include discussion about the expected duration and frequency of appointments, depending on the issue presented.

EAP, in addition to counseling services by licensed clinicians, offers several advantages over similar services offered in the community. Because EAP is located on site, it’s easy to access services. Counselors also have direct knowledge of the Lab’s unique working environment, and can help direct employees to other benefits available through the Laboratory.

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Employee Assistance Program Q&A

How do I make an appointment? Simply call 3-6609 (423-6609) to schedule an appointment with an EAP counselor. On-site counselors are available to employees and their families during regular business hours (8 a.m. to 5 p.m., Monday through Friday).

Are my visits to the EAP confidential? We will discuss confidentiality in more detail in a future article. If you have questions, please give us a call.

What is the cost for coming in for counseling? Because the services EAP provides are a benefit to the employees, there is no cost for on-site counseling.

I am a subcontractor. Where do I go for assistance? Check with your employer. For example, IAP World Services provides external EAP services for its employees. An access number can be obtained from your employer’s administrator.

LLNL’s Employee Assistance Programs are available only to LLNL employees and their dependent family members. For more information call 423-6609, or visit the Web site at http://www-r.llnl.gov/healthserv/Services/eap.html or http://www.llnl.gov/healthserv/eap/

SCIENCE NEWS

Researchers synthesize unique 'noble' metals under extreme conditions

By Anne M. Stark
Newsline staff writer

New research shows that a novel class of nitrides made from "noble" metals can be synthesized under extreme conditions and are likely to have unusual or even unique properties that would be useful in semiconductor, superconductor and corrosion-resistant devices.

Historically, transition metal nitrides are fundamentally and technologically important because of their strength and durability, and are useful for their optical, electronic and magnetic properties. ("Nitride" is the name given to a nitrogen-containing compound in which nitrogen more strongly attracts the relevant electrons in the chemical bond.)

Using a diamond anvil cell to create high pressures and a laser to create high temperatures, Laboratory scientists, in collaboration with researchers from the Carnegie Institution of Washington and the Atomic Weapons Establishment in England, created the first bulk nitride of the noble metal iridium.

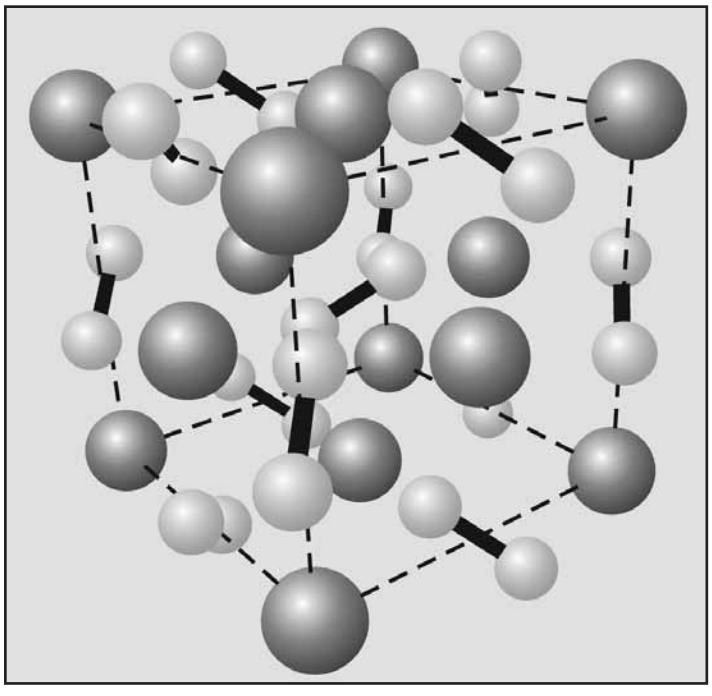
Noble metals are those that do not form compounds with other elements very easily. By combining experimental results with first-principle theoretical modeling, the scientists also have determined the structure of the known nitride of platinum as well as its bulk modulus (a measure of the material hardness). The results could prove useful to the semiconductor industry by making them more durable and reliable.

"This work extends the scientific understanding of platinum and iridium nitrides," said lead author Jonathan Crowhurst of the Chemistry and Materials Science Directorate. "Demonstrating that these compounds exist and determining at least some of their physical properties should inspire the development of large-scale synthesis techniques to take advantage of their unusual properties. Platinum nitride, for example, has been shown to have a very high bulk modulus comparable to that of cubic boron nitride — a known super-hard material."

The semiconductor industry currently uses titanium nitrides because of their strength and durability. The new nitrides may prove to be even more durable than titanium.

For platinum nitrides, synthesis conditions began at approximately 50 GPa (or 500,000 atmospheres of pressure) and 2,000 degrees Kelvin. Iridium nitrides were similar and would not occur below 47 GPa and 1,600 degrees Kelvin.

Further research is necessary to find a way to produce the nitrides industrially.



Newly proposed structure of platinum nitride. Dark gray and light gray spheres represent platinum and nitrogen, respectively.

Other Livermore authors include Babak Sadigh, Cheryl Evans, James Ferreira and Art Nelson. The research, titled "Synthesis and Characterization of the Nitrides of Platinum and Iridium," appears in the March 3 edition of the journal *Science*.

Lab co-sponsors high-energy density astrophysics conference

The Laboratory in conjunction with Rice University, Los Alamos National Laboratory and the American Physical Society, is sponsoring the Sixth International Conference on High Energy Density Laboratory Astrophysics (HEDLA-06), March 11-14.

During the past decade, research teams around the world have developed astrophysics-relevant research using high-energy density facilities such as intense lasers and Z-pinches.

Bruce Remington of the Laboratory's National Ignition Facility Directorate serves on the organizing committee for the conference and Wil van Breugel of the Institute for Geophysics and Planetary Physics serves on the scientific advisory board.

The bi-annual conference was started in 1996 in Pleasanton by Remington, who organized about 50 physicists to get together to discuss high-energy density research and the potential for doing scaled laboratory astrophysics experiments. From there, the conference has grown to occur every other year with an expanding group of researchers attending. The conference was held in 1998 at the University of Arizona, in 2000 at Rice, in 2002 at the University of Michigan, and in 2004 at the University of Arizona.

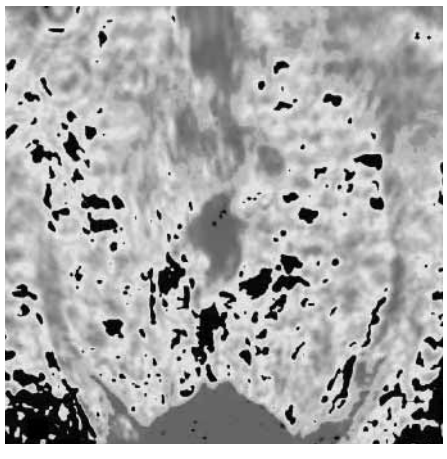
High-energy density laboratory astrophysics research encompasses many areas, such as compressible hydrodynamic mixing, strong shock phenomena, radiation flow, radiative shocks and jets, complex opacities, equations of state, superstrong magnetic fields and relativistic plasmas. Most research uses the Omega laser at the University of Rochester, the Z machine at Sandia National Laboratories, and other laser and magnetic pinch facilities worldwide.

Future astrophysics-related experiments are now being planned for the two-megajoule National Ignition Facility (NIF) laser at the Laboratory, the two-megajoule Laser Megajoule (LMJ) in Bordeaux, France; petawatt-class lasers now under construction in several countries, and the future ZR pinch facility at Sandia National Laboratory in Albuquerque.

The conference will focus on this new and growing research area.

Topics include:

- Stellar evolution, stellar envelopes, opacities, radiation transport;
- Planetary Interiors, high-pressure EOS, dense plasma atomic physics;
- Supernovae, gamma-ray bursts, exploding systems, strong shocks, turbulent mixing;
- Supernova remnants, shock processing, radiative shocks;
- Astrophysical jets, high-Mach-number flows, magnetized radiative jets, magnetic reconnection;
- Compact object accretion disks, X-ray photoionized plasmas;
- Ultrastrong fields, particle acceleration, collisionless shocks.



A jet in a Z-pinch experiment.

For more information, go to http://www.hedla.org/

Women's History Month activities kick off March 8

In celebration of Women's History Month, educator and speaker Rosalyn Taylor O'Neale will present "Driving Change & Creating Greatness," noon-1 p.m., Wednesday, March 8, in the Bldg. 543 auditorium. The topics include embracing the role of passion in driving change, achieving the seven keys to greatness and the cornerstones of global inclusion.

The talk is sponsored by the Laboratory's Women's Association (LLLWA); the Lesbian, Gay, Bisexual and Transgender Association (LGBTA); the Association of Black Laboratory Employees (ABLE); and the Work-life Center. For more information, contact the Work-Life Center at 2-9543 or see the flier.

As part of Women's History Month, LLLWA is running a used book sale at the old Central Cafeteria the week of March 20, and the LLLWA Scholarship ceremony will take place March 29 at noon in Bldg. 543 auditorium. Look for more details in *Newsonline*.

COVER STORY

JASPER gas gun builds legacy of shock physics success

By David Schwoegler
Newsline Staff Writer

"The JASPER team successfully executed our first plutonium shot today at 2:35 p.m.. The data demonstrate superb quality, and a preliminary analysis indicates that JASPER will meet its intended goal of generating high-precision plutonium data. Initial re-entry surveys show full containment. The shot specifics were 5.22 km/s (11,677 mph or mach15.74), firing a 13-pin, heavy projectile weighing about 30 grams or 1 oz."

So began an enthusiastic e-mail from [then] test director Mark Martinez immediately following the shot on July 8, 2003.

That day the Laboratory achieved a major milestone and began an impressive scientific legacy of successful firings for the JASPER Gas Gun at the Nevada Test Site. Starting in March 2001, the gas gun completed a series of 20 inert or non-nuclear shots to qualify it for use with nuclear materials. That first Plutonium shot marked the culmination of years of effort in facility construction, gun installation, system integration, design reviews and authorizations to bring the experimental facility on line.

The gun's winning streak has continued until today. Successful shots are no longer big news. Even though all the details may not have been inked in print, the cumulative results remain amazing. In total, JASPER has racked up 48 shots: all successful. That number includes 17 plutonium shots and 31 experiments involving surrogate materials. The most prolific calendar year was 2004, when 15 shots were fired.

JASPER, an acronym for Joint Actinide Shock Physics Experimental Research, is a nearly 100-foot, two-stage gas gun, built at a cost of $20 million inside existing facilities within Area 27 at the Nevada Test Site. Inside the gun's first stage, hot gases from burning gunpowder drive a heavy piston down a pump tube, compressing hydrogen gas. That gas builds up to extremely high pressures, breaks a valve, then enters the narrower barrel of the second stage, propelling the projectile — which is housed in the barrel — towards the target. JASPER can fire small projectiles at velocities of up to eight kilometers (five miles) per second, which is nearly18,000 miles per hour, or more than 24 times the speed of sound. And JASPER's economics are highly cost-effective. The gun potentially can fire up to 24 experiments per year, and costs about $6 million annually, with an expected 10-year lifetime.

The JASPER gas gun target chamber.

Although similar two-stage light gas guns have been in operation at Lawrence Livermore, Los Alamos and Sandia national laboratories for many years, they cannot perform experiments on plutonium, other actinides or other hazardous materials. Livermore operates JASPER, but the gun sees multi-laboratory experimental use.

In the absence of full-scale nuclear testing, JASPER's role in Science Based Stockpile Stewardship — along with subcritical experiments — is to help assess the properties of nuclear weapon materials to verify that aging weapons can perform as designed. An important experimental technique to determine the properties of materials at high temperatures, pressures and densities is to shock the material, then measure its response, according to chief scientist Neil Holmes.

So Lab scientists fire a tantalum projectile at over five kilometers per second at a plutonium target. The impact produces a high-pressure shock wave that passed through the target in a fraction of a microsecond. During this extremely brief period, diagnostic equipment measures the properties of the shocked plutonium inside the target. These shock-physics experiments complement ongoing subcritical experiments at the Nevada Test Site. "

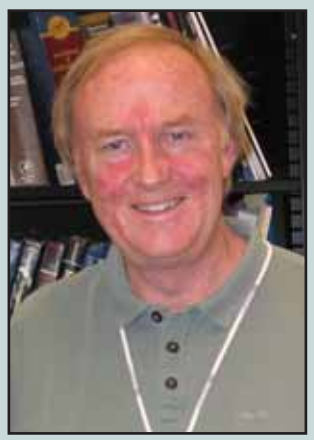
JASPER continues to validate itself as a vital tool for plutonium shock physics. Everything has worked exactly as planned. We now are looking forward to shot number 49," said Holmes.

The JASPER two-stage gas gun at the Nevada Test Site.

Holmes is a driving force behind JASPER success

Since 1998, Neil Holmes has been a pacemaker for the scientific heartbeat at JASPER. Test directors have come and gone. So have Livermore site managers and N-Program leaders at NTS. But ever-present as project scientist, Holmes has been a linchpin of continuity and stability in this successful string of shock-physics experiments.

After receiving his Ph.D. in physics from Stanford University, Holmes joined the Lab in 1977. He says the highlights of his Livermore career are the high-quality data gleaned from the JASPER shots, coupled with the high-caliber team that puts those shots together. A serious gourmet, Holmes added jocularly that, "The food has gotten much better in Las Vegas, too." Holmes wants to complete more major plutonium milestones at the Nevada gas gun before he even thinks about retirement. In the meantime, this single physicist will continue to mastermind the science at JASPER, while he leads a double life in San Joaquin County as a professional large-format photographer and photography instructor. Holmes says one pet ponderable he wants to learn is, "How do materials return to an equilibrium state after they've been shocked?"



Neil Holmes

While there is no formal betting line on this topic at the Las Vegas sport books, one bet is that the Lab's top gas-gunslinger at NTS will find an answer long before he pulls the pin on his career.

PROFILE IN SCIENCE

Veteran scientist Troy Barbee helps pioneer the hot new field of nanotechnology

By Charles Osolin
Newsline staff writer

Troy W. Barbee Jr. spent part of his youth knocking heads on the football gridiron and rugby pitch, but he found his true calling on a much smaller playing field.

Barbee, a senior materials scientist at the Laboratory, is a pioneer in the hot new field of nanotechnology, in which scientists manipulate materials a few atoms at a time.

In the mid-1970s, as laboratory director of the Center for Materials Research at Stanford University, Barbee wrote one of the first papers describing what he termed "atomic engineering in its infancy." Since then he has been working to perfect and apply the technique to the creation of unique multilayer materials with properties that can't be found in nature.

"I realized very early on that I could walk into a lab any day of the week and choose to make something nobody else had ever made," Barbee said. "That's very exciting but it's even better if you have a goal in mind."

Among the goals Barbee's multilayer materials have already reached:

- Advanced multilayer optics that provided the first detailed pictures of the sun's magnetic corona, and are now enabling the creation of the next generation of ground- and space-based telescopes, computer chips and hard disk drives
- Diagnostic tools and control systems that support the development of the world's most powerful lasers and the reliability of the nation's nuclear weapons stockpile X-ray interferometers to study colliding plasmas, essential in the development of nuclear fusion and its promise of unlimited energy Revolutionary "NanoFoil®" technology that can solder heat-sensitive materials at low temperatures.

"Troy's passion for creating new materials technologies is intoxicating," said Timothy Weihs, a former postdoctoral researcher in Barbee's laboratory, who went on to help found the company that developed NanoFoil. "He can fill a room with his enthusiasm and his drive. He's simply very gifted at making new materials."

Multilayer materials are like tiny Dagwood sandwiches. They're composed of anywhere from a few to hundreds of thousands of alternating layers of two or more substances, each as thin as a few atoms. At the nanoscale – one-billionth of a meter – the normal boundary and grain structures that constrain a substance's properties can't form, and the laws of classical physics and chemistry give way to the weird uncertainties of quantum mechanics. "One must expect the unexpected" when doing multilayer research, Barbee said.

In creating multilayer materials, scientists can manipulate the thickness of two adjacent layers so they're identical to the interaction lengths characteristic of important physical properties, such as magnetic interaction lengths. The process can yield entirely new properties: extraordinary strength, hardness, heat resistance and optical reflectivity at very short wavelengths.

"Every atomic layer can be part of an interface," Barbee said, "and we can look at interfacial properties that are not accessible by any other means."

Barbee, who played tackle at Stanford on a football scholarship and was named to the Pac-10 All-Conference team in 1957 — also receiving 2nd team and honorable mention All-American recognition — earned his undergraduate degree in metallurgical engineering. His freshman academic adviser had advised him to "to look around and find what you really want to do," he said. "I found metallurgical engineering and materials science, which I really liked."

For his Ph.D. in materials science engineering from Stanford, he did a joint dissertation with the Physics Department and had labs in both the physics and the materials science buildings. "I was way ahead of the curve for interdisciplinary research," he said. "It was a kind of epiphany – I found that it's a very productive way to work. Now I'm spending my whole time at that interface."

Barbee and his multidisciplinary team of materials scientists, engineers and physicists are asked "to do the things everybody else says are impossible," he said. "And we're the logical ones to do it, because we have such good technicians and engineers working on this. We're the guys that should be doing this work."

JACQUELINE MCBRIDE/NEWSLINE

Troy Barbee

At Stanford's Center for Materials Research, Barbee took on the challenge of improving the structural integrity of thick metal films. He hit on the idea of using an emerging technique called magnetron sputtering, in which a material is bombarded with electrically charged particles, knocking loose some of its atoms. The atoms are then deposited on a target surface, where atomic bonding forms a stable coating.

Using an existing vacuum system and $13,000 left over from another project, Barbee and his collaborators successfully layered copper with a variety of other metals, and eventually created a tungsten-carbon multilayer of extremely high structural quality and X-ray reflectivity — ideal, as it turned out, for X-ray optics. This magnetron sputter deposition technique was reported to Congress by the National Science Foundation in 1976 as one of four major breakthroughs in materials science that year.

"This materials synthesis technique opened up a whole short-wavelength spectral domain not easily accessible otherwise," Barbee said. "Every time we made an advance and improved the quality (of the multilayer) in terms of X-ray diffraction, we improved the structural quality of the multilayer or nanolaminate material. These materials now are essentially perfect from an X-ray optics perspective."

Barbee came to Livermore in 1985 and set out to advance the sputtering process, develop more advanced multilayer optics, and explore a wider range of multilayer applications. His coatings for telescope mirrors have enabled them to focus light from space in the X-ray and extreme ultraviolet (EUV) wavelengths. The high-resolution optics allow astrophysicists to study previously unseen features of astronomical objects, such as the fluctuating magnetic fields on the sun

See BARBEE, *page 5*

Around the Lab

Bowling over the competition

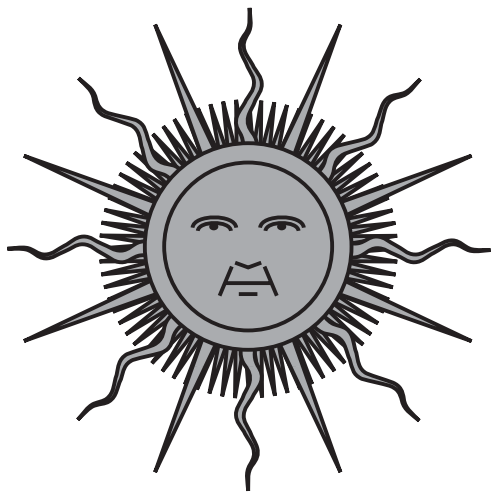
Jacqueline McBride/Newsline

(From left) Christel Cantlin, Leonard Walton, Jenni De Pruneda and Jason Miller of the Nonproliferation, Arms Control, and International Security Directorate (NAI) celebrate after winning the second annual African-American History Bowl, sponsored by the Association of Black Laboratory Employees (ABLE) this week. The event was the culminiation of this year's Black History Month.

Melanoma Surveillance Program ends

The Melanoma Surveillance Program, also known as "Mole Patrol" or "Spot Check," is approaching completion.

The project began in 1984 after studies showed a threefold increase in melanoma incidence among Lab employees in the mid to late 1970s. During the 1980s the Lab's melanoma incidence remained stable, while the community and the rest of the country experienced a persistent increase. By the late 1980s the rate of invasive melanoma at the Lab and the surrounding community had equalized. The death rate from melanoma at the Lab was never elevated and was in fact lower than expected during the period 1984 to 1996, as shown in a recently completed study.



Information on the history of cancer surveillance at LLNL can be found at http://www-r.llnl.gov/healthserv/News/surveillance.html .

The program will officially end on April 30. A meeting will be held for all LLNL staff on May 3, 11:30 a.m.–1:30 p.m., with presentations summarizing the history of the melanoma experience at the Laboratory.

Health Services will assist former Mole Patrol patients in transitioning care to their personal physicians by providing additional copies of skin photographs that patients may no longer have, or initial or replacement pathology reports and other related records. Health Services can also provide a standard letter from Dr. Jeffrey Schneider, Mole Patrol dermatologist, with recommendations for follow-up, to facilitate proper referrals through employees' personal physicians. These items may be requested by calling Health Services at 422-7462, or by completing a release of health information form (see http://www-r.llnl.gov/healthserv/services.html, Health Information Forms, Obtain and Release Health Information; mail the form to Health Services at L-723.

The Health Services Department will continue to educate employees about melanoma, other skin cancers, and sensible sun habits, but future responsibility for diagnosis and treatment will be returned to employees' personal physicians. For additional information, call Health Services at 422-7462.

BARBEE

Continued from page 5

that help create solar flares and eruptions.

Closer to home, multilayer mirror coatings are the foundation of a major Department of Energy Cooperative Research and Development Agreement (CRADA) involving Livermore, its sister laboratories Sandia and Lawrence Berkeley, and about a half-dozen semiconductor manufacturers. Using a process called extreme ultraviolet lithography, or EUVL, the project is aimed at substantially advancing computer technology by squeezing more transistors and other integrated-circuit features on computer chips. The narrow wavelength of EUV light, about 13 nanometers, allows the EUVL system to print integrated circuit features of 50 nanometers or smaller.

"The first images of the sun with multilayers in 1987 really put EUVL in motion," Barbee said. "We demonstrated we could get these resolutions, so the researchers pushed ahead in the lithography area."

Recognizing the potential of multilayer materials in other applications besides optics, Barbee and Weihs, his postdoctoral researcher, began investigating their use as thermal barrier coatings in the mid-1990s. The team worked to develop reactive nanolaminate materials as a means to form high temperature-high performance materials and potentially bond materials in new ways.

Weihs left Livermore in 1995 to join the faculty at Johns Hopkins University, where he teamed with another Hopkins professor, Omar Knio, to further develop reactive foils for use as localized heat sources for soldering and brazing. In 2001, Weihs and Knio founded Reactive NanoTechnologies in Hunt Valley, Md., to commercialize NanoFoil, an aluminum-nickel multilayer material that can release heat energy in a predictable and controllable manner.

NanoFoil can solder heat sinks to computer chips without damaging them. It also can be used to bond metals, ceramics and polymers, and it can bond dramatically dissimilar kinds of materials without causing them to crack. The technology won an R&D 100 Award from *R&D Magazine* as one of the top industrial innovations of 2005.

"Troy has an amazing ability to both innovate and to execute," Weihs said. "He can conceive a new materials technology and then he can perform, either directly or indirectly, all the materials development that is required to bring that technology to life."

Among their 18 patents, Barbee and his colleagues hold two "state of matter" patents for reactive foils — having created, in effect, a totally new class of matter — with six more patents pending.

Barbee said finding useful applications for basic research "is like shooting an arrow into the air and painting a target where it hits. Or as a Nobel-prize-winning chemist once remarked, when asked to define basic or fundamental research, 'basic or fundamental research is not-yet-applied research.'

"We really try to do that in this place," he said. "The power of a lab like Livermore lies in the translation of science to technology in as rapid and efficient way as possible. We do very basic stuff, but we do it for a reason, and it gets put to use very quickly. That's what makes the job very exciting for me.

"I'm 68, and now you know why I'm still here; I'm just having a blast. I'm intellectually challenged every day. This work keeps you young."

PEOPLE NEWS

RETIREES' corner

Retirees **Nick Williams** (Electronics Engineering, 2002) and **Leo Gross** (Mechanical Engineering, 1999) are actively involved with the U.S. Coast Guard Auxiliary. Leo is a pilot and Nick flies as an observer aboard single- and twin-engine aircraft flying out of Livermore airport on safety patrol missions for the Coast Guard, such as the Delta, San Francisco Bay, through San Pablo, Grizzly Bay, Suisun Bay and the deep water channels to Stockton and Sacramento. Coast Guard Auxiliary members look for anything out of the ordinary, from boaters and ships in trouble, to hazards to navigation and environmental concerns such as oil spills, security area violations or buoys out of position. Leo owns a single-engine aircraft qualified to use for the auxiliary. Both retirees volunteer their time and aircraft for this important mission for the Coast Guard.

Jan and **Harold Pfeifer** (EPD, 1993) recently flew to the Antarctic via Buenos Aires and Ushuaia, Argentina, and took a cruise on Orient Cruise Line (MV Marco Polo). They toured Buenos Aires . They flew to Ushuaia (southernmost city in the world) where they boarded the Marco Polo. For three days they sailed to the Antarctica Peninsula, passing through inland waterways and inlets with glaciers and icebergs. They observed many birds, whales spouting, and of course, islands with penguins. They visited three penguin colonies (one each day) via Zodiacs to/from the ship and saw penguins "up close and personal." They could have watched these animals for hours, but the constraints of time and weather prevented too much viewing. They observed a variety of penguin species on each of the three landings. After their return to Ushuaia, they visited Tierra del Fuego Park. The mountains, flat lands, small lakes and rivers presented many photo stops.

The Travel Group meeting is at 2 p.m. Tuesday, March 28, in the community room of the Livermore Police building, 1110 S. Livermore Ave. The topic is "Art Tour of Spain and Portugal," by **Margo** and **Arnie Kirkewoog**.

The March's retiree luncheon will be at noon Wednesday, March 15, at the Elks Lodge in Livermore, 940 Larkspur Drive. Reservations: www.llnlretirees.org.

The speaker will be **John Marchand**, senior chemist for the Alameda County Water District. His talk is entitled, "All About Water."

Send input to **Jane** or **Gus Olson,** e-mail: AugustO@aol.com or JaneRubert@aol.com. Phone: (925) 443-4349, snail mail address: 493 Joyce St., Livermore, CA 94550.

in MEMORIAM

Alice Conover

Alice Conover, who worked as a chemist at the Lab before retiring in the early 1990s, died Jan. 11. She was 72.

A native of New Jersey, she had lived in Livermore for 40 years. She enjoyed and supported the performing arts and theater in the community.

She is survived by her sister and her husband, Janet and Richard Steelman of Virginia, and nephews, John Streu, Russell, David and Jameson Bradley.

Services were held in Livermore.

Janet M. Wikkerink

Janet M. Wikkerink, a 42-year resident of Livermore, died on Jan. 26. She was 66.

A native of Oswego, N.Y. she worked at the Laboratory for 22 years. She enjoyed basket weaving and traveling.

She is survived by her son, James W. Wikkerink of Virginia Beach. Va.; brother Dale Turner of Livermore: and three grandchildren.

Services were held. Donations may be made in her name to Sunset Community Church.

Bill Thomas

Bill Thomas, a retired Lab employee who worked as a mechanical technician in Mechanical Engineering for 40 years, died Feb. 16. He was 85.

Born in Carmen, Okla, Thomas was a 47-year resident of Livermore. He was a member of the Holy Cross Lutheran church in Livermore. He was an avid airplane builder. He enjoyed the challenge of constructing planes and test-flying them.

He is survived by his wife of 56 years, Peggy; son, Michael Thomas of Livermore; two grandchildren; and a great-grandchild.

Services were held in Livermore.

Wayne H. Stewart

Wayne H. Stewart, a carpenter at the Laboratory for 28 years until his retirement in 1984, died on Jan. 4. He was 73.

Stewart was born on June 26, 1932 in Hayward. He was a 60-year resident of Livermore.

After his retirement, he continued his craft with many design and building projects at home. He enjoyed gardening, fishing, traveling and shopping. He was active in the VFW and a member of Native Sons at the Golden West and the Elks Lodge.

He is survived by his wife of 53 years, Joan Stewart; daughters Wendy Bishop of Tracy, Mary Getz of Lake Almanor and Kathy Sullivan of Ripon; sisters, Joyce Rout of Tracy and Barbara DeMarco of Livermore; and grandchildren.

Services were held in Livemore. Donations may be made to Kaiser Martinez Hospice, 200 Muir Road, Martinez or Tri-Valley Animal Rescue, P.O. Box 11143, Pleasanton.

Jack Savage

Jack Savage, a 45-year resident of Livermore, died Jan. 6. He was 87.

Born in Vallejo, Savage worked as an electrical engineer for 60 years, primarily at the Laboratory. He enjoyed music, history and science.

He is survived by his wife, Harriet W. Savage of Livermore; daughters Sharon Hawley of Sacramento, Linda Conley of Modesto and JoAnne Savage of Livermore; sons Jack W. Savage II of Modesto and Laurence Savage of Reno, Nev.; seven grandchildren; and five great-grandchildren.

Services were held.

Hugh D. Wilson

Hugh D. Wilson died at his home in Livermore on January 14. He was 78.

Wilson was born on November 18, 1927 in Yonkers, New York. He served in the U.S. Army with the 82nd Airborne Division. He earned his B.S. degree in chemistry in 1954 from the University of Nevada, Reno. He began working at the Lab in 1956, retiring in 1987.

He was a member of the LLNL Retirees, Sons in Retirement (SIRS), and the Livermore Valley Coin Club. He and his wife Carole were actively involved in the Del Valle Dog Club for many years and were made honorary lifetime members. He was an avid coin collector and enjoyed traveling.

He was preceded in death by his wife of 50 years, Carole; his parents, Walter and Miriam Wilson; daughter, Carole Ann Wilson, and brother, Jay Wilson. He is survived by his son, William "Mr. Bill" Wilson of Livermore; his daughter Sharon Wilson and her husband Lynn Boutilier of Washoe Valley, Nev.; his sister, Mary Catherine Wilson of Sparks, Nev.; his nephew, Jason Wilson of Alamogordo, N.M.; and numerous cousins, nephews and nieces.

A memorial service was held in Livermore.

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Small mammals are ecological giants in local grasslands

Despise or adore them, local burrowing mammals are receiving more attention as "big players" for their contribution to the overall well-being of California's ecological communities.

Ecological communities are defined as a group of interacting species living in the same place. A community is linked by the network of influences that species have on one another, great or small. One species may affect another one or numerous others in its ecological role. This concept has become popularized by the term, "the balance of nature," and speaks to the complexity of levels of interaction that are occurring in any given community at any given time.

Common yet a keystone species

California ground squirrels *(Spermophilus beecheyi)* are being investigated as a "keystone species" for the California prairie ecosystem. This is a species whose presence or absence, or significant increase or decrease in population size, profoundly affects other species' survivability in that habitat. Recognition of this ecological standing is usually derived from the results of studies in which the species is added or removed from the community.

The term "keystone species" comes from the center stone in a Roman arch that supports the majority of the structure's weight. Removal of this keystone causes the entire form to collapse. In this way, removal of a keystone species can lead to the local extirpation of many species and negative effects on the overall health of the ecosystem.

Why are ground squirrels of heightened interest to ecologists? More than 200 other wildlife species have been sighted using ground squirrel colonies. Some species prey upon ground squirrels while others use their burrows for shelter. In Central California, common wildlife visitors to areas of ground squirrel occupation include red-tailed hawks, coyotes, golden eagles, northern Pacific rattlesnakes, and burrowing owls. Also, a long list of insects and plant species are associated with the colony's construction area.

Additionally, squirrel feeding activities result in a tilling or churning of the soil, enhancing its ability to support plants. A greater vegetative diversity – with nitrogen-rich mixtures of grasses and forbs – offers sustenance to other animals. This enriched habitat attracts a wide array of grazers and browsers that wish to utilize these food resources. Ecologically heralded as the food web hierarchy, this diverse association of plants and wildlife is dependent on the squirrel's presence for life.

American badgers

Another subterranean species that is gaining notoriety as an ecosystem giant in the California's grassland prairie is the American badger (Taxidea taxus). Although not receiving the accolades of the keystone species, the badger is a close runner-up as an "ecosystem engineer." This term denotes an organism that creates or modifies the physical environment in a significant way over time. Beavers (Castor canadensis) are the stereotypical ecosystem engineer because of the effects their dams have on stream flow, geomorphology, and the surrounding ecology and life forms that use the region.

Badgers also do their share of native engineering by modifying the landscape and soil nutritive richness. By loosening and aerating the soil, they speed up the decomposition of vegetation, enhancing nutrient availability. During wildland fires, these soils can serve as firebreaks for down-hole escapees. Since badgers were part of the ecological setting before humans, they may ultimately be connected to the presence and restoration of native plant species and their seed banks. The large soil excavation mounds at the entrance of badger dens result in the mixing of nutrients and soil conditions as deep soil is brought to the surface. Badger burrows can act as homesteads to other wildlife species including rabbits, salamanders, frogs, snakes and long-tailed weasels, especially during the hot summer months. Badgers have been known to work "collaboratively" with hawks and coyotes to raid pocket gopher and squirrel holes (see inset photo).

Regardless of the colorful scientific moniker used to identify these species and their ecological roles, current research suggests that these two California underground inhabitants play a bigger role in shaping the natural environment than was previously believed.

RON ARGANBRIGHT/MMED

LLNL's wild side

By Jim Woollett

JIM WOOLLETT/EPD

Badgers (left and below) are prairie ecosystem engineers. The ground squirrel (above) also plays an important role in the food web hierarchy.

Security Department to close Avenue B security post today

The Lab's Security Department has announced that security post 3B, on the north side of the intersection of Avenue B and Third Street, will close permanently beginning 6 p.m. today (March 3) —except for Fire Department emergency vehicle traffic. The closure is one of several cost-driven service reductions needed to meet the department's FY 2006 budget reductions.

Within approximately one block of pPost 3B, three alternate access points for use by pedestrians and bicyclists who must travel northbound or southbound in that area. The access booths are long enough to accommodate a bicycle and rider who has dismounted.

Adjacent to each booth is either an electronic or manual turnstile for pedestrian access only. The electronic turnstile allows passage in either direction; the manual turnstile permits passage only from the Limited Area (LA) to the Property Protection Area (PPA). Employees who encounter problems with either the electronic access booths or turnstiles should call the PFD Alarms Console at 2-7222 to report malfunctions.

The post 3B closure means that approved motor vehicles must use an alternate entry point when traveling between the LA and PPA. Alternate vehicle entry/exit points are security post 1D, at the east end of First Street, north of Blgd. 316; and post west fate (P-WG), at the west end of First Street, northwest of Bldg. 111. Post 1D is open all hours every day. P-WG is open 6:30 a.m.-6:30 p.m., Monday-Friday, and closed on weekends and holidays.

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